ALNOR®

INSTRUMENT COMPANY

OWNER'S MANUAL

TYPE 8500 THERMO-ANEMOMETER

FAILURE TO RETURN THIS MANUAL

WILL RESULT IN A CHARGE OF

$2500

Quick-rental® instruments

MANUAL NO. 116-021-005

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1. General Description

The Alnor Type 8500 Thermo-Anemometer is a precision instrument designed to measure the velocity of air or gas up to 2000 feet per minute (10.16 meters per second). It uses a heated thermocouple anemometer in a carefully constructed probe and an accurate indicator. All operating power is provided by a battery contained within the indicator enclosure. Useful battery life is approximately 85 hours. The indicator is equipped with a mirrored scale to eliminate parallax error from readings.

2. Principles of Operation

The Alnor Type 8500 instrument is a constant-current, heated thermocouple anemometer. Within the tip of the probe a short straight wire is heated by a controlled current from a battery. The wire excites a small thermocouple junction. The reference (compensating) for the thermocouple is located near the base of the element, away from the heated wire, but in the air stream.

At very low air flow, the thermocouple reaches its maximum temperature, causing the indicator pointer to remain near the low (left) end of the scale. As the air flow increases it cools the thermocouple junction, reducing its output voltage. A compensating network contained in the probe handle senses the change and transmits a current which drives the pointer upscale.

The output of the thermocouple is proportional to the difference between the temperature of the air stream and the temperature of the heated wire. The useful air stream temperature range is between 20°F (−6°C) and 150°F (65°C). The anemometer is calibrated for standard conditions of 68°F (20°C) and 760mm Hg, but since it operates on the mass flow principle it indicates standard velocities under conditions which depart in small amounts from standard.

3. Specifications

Specifications of the Alnor Type 8500 Thermo-Anemometer are listed in Table 1.

Table 1. Specifications

Scale Range	LO: 10 - 300 FPM (0.05 - 1.5 M/S) HI: 100 - 2000 FPM (0.5 - 10 M/S)
Accuracy	The larger of ±2 FPM or ±3% of indicated velocity
Temperature Range of Probes	20°F (−6°C) to 150°F (65°C)
Ambient Operating Range of Indicator	40°F (5°C) to 120°F (49°C)
Storage Temperature (with battery)	10°F (−12°C) to 90°F (32°C)
Response Time	10 seconds
Indicator Dimensions (Excluding Handle)	8-7/8" x 7-1/2" x 4-1/2" (22.5cm x 19cm x 11.4cm)
Indicator Weight	6 lb 13 oz (3.09 kg)
Power Requirement	Self-contained power source in indicator housing. 1 Mallory RM42 cell.
Useful Power Cell Life	85 hours approximately

4. Instrument Selection

Available Thermo-Anemometers and probes are described in Table 2. One meter and one probe comprise a working set.

Table 2. Instrument Selection

Model	Description	Part Number
8500	Meter 10 - 300 and 100 - 2000 FPM	634.210.004
8500	Meter 0.05 - 1.5 and 0.5 - 10 M/S	634.211.017
1520	Probe - 6'' long	634.230.010
1520-12	Probe - 12'' long	634.230.028
1520-18	Probe - 18'' long	634.230.035
1520-24	Probe - 24'' long	634.230.042
Standard cable length on all probes is 5 ft.		

5. Operation

5.1 The operating controls of the Type 8500 Thermo-Anemometer are located on he instrument panel, easily accessible when the case is opened. The controls are illustrated in Figure 1, and described in Table 3.

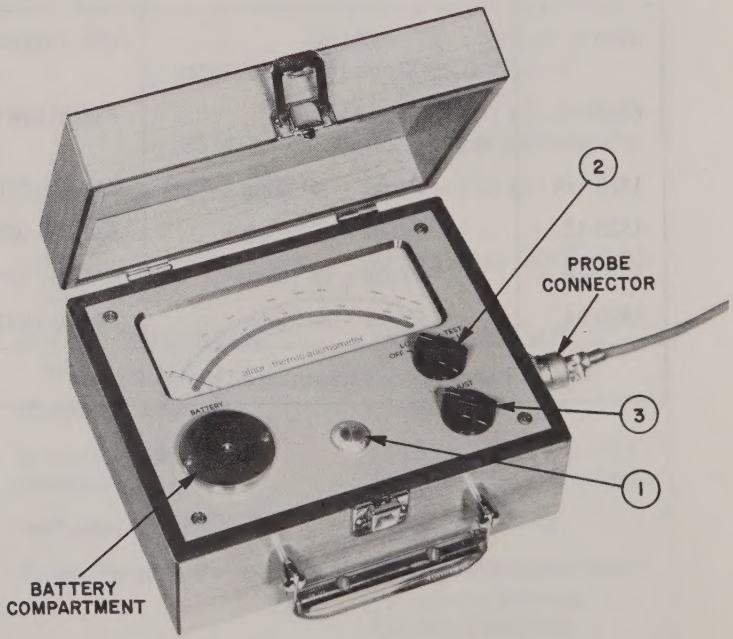

Figure 1. Operating Controls

Table 3. Operating Controls

Index No. (Figure 1)	Name	Description
1	Zero Adjust	Rotary control. Adjusts zero position of pointer when probe is disconnected from instrument. Requires Function Switch to be in LO position.
2	Function Switch	4-position rotary switch. OFF position disconnects battery power. LO position enables measurements in 0 – 300 FPM (1.5 M/S) range. Also enables Zero Adjust. TEST position enables 'T' ADJUST control. HI position enables measurements in 0 – 2000 FPM (0 – 10 M/S) range.
3	'T' ADJUST	Rotary control used in conjunction with LO position of Function Switch to compensate instrument for condition of battery.

5.2 Operating Procedure

CAUTION

Always keep protective cap on probe to protect element when not in use.

1. Open instrument cover. Remove cover, if desired, by sliding it on hinge pins.
2. Do not connect probe. Turn function switch to LO position. Use Zero Adjust to set pointer at Z mark on meter scale.

3. Return function switch to OFF position. Mate plug on end of probe cable with receptacle on right side of case. Lock connection by turning knurled ring into threaded shell of receptacle.
4. Turn function switch to TEST position. Rotate 'T' adjust control to bring indicator to T mark on indicator scale. Allow a few minutes for power cell current to stabilize and, if necessary, reset pointer to T mark. Remove plastic protective cap from probe.
5. Place the probe in the air (gas) stream, and position the probe so that the flow is perpendicular to the plane of the element. The red dot on the probe handle should be in a plane perpendicular to the air flow (e.g., up or down when flow is left to right or right to left).
6. Turn the function switch to LO or HI, as required by expected indication. If pointer moves off scale in LO range, switch to HI. Rotate the probe slightly in both directions until maximum pointer deflection is obtained.
7. For greatest accuracy, repeat 'T' adjustment and repeat measurement.
8. When a single measurement is complete, turn function switch to 'T' position, withdraw probe and re-attach protective cap immediately. When a set of measurements is complete, turn function switch to OFF position to conserve power cell.

6. Practical Applications

6.1 Air Velocities in Open Spaces

Remove protective cap from probe and hold plane of probe perpendicular to air flow. Maximize indication as described in step 6 of operating procedure.

6.2 Air Velocities at Supply Openings

When it is desired to determine the volume output of an opening having no grille, use the following equation:

$$Q = AV$$

where Q = flow rate in cubic ft/min or cubic MPS
A = area in square feet or square meters
V = average velocity in FPM or MPS

If the opening is covered by a grille, divide the opening into a number of equal areas. Measure the velocity at the center of each. Generally 6 to 20 measurements will be adequate. It is suggested that the probe be held about 1 inch downstream from the grille. The average velocity of all areas will then be 'V' in the above equation. 'A' will be core area.

6.3 Velocities Inside of Ducts

To measure velocities inside of ducts, it is necessary to have an opening in the duct wall available. In case there is no opening provided, a hole 5/16 inch in diameter must be drilled for insertion of the probe.

Since air velocities are rarely uniform within the entire cross secion area of a duct, it is necessary to determine the average velocity. In general, the greater the number of readings taken, the higher the accuracy which will be achieved in calculating the average velocity.

In measuring the velocity inside of the duct, it is important to select a location where the flow is more uniform and where there is little turbulence. The best locations to measure are usually along straight runs of duct, preferably at 10 duct diameters downstream from the nearest turn, transformation, damper, or other source of turbulence.

6.4 Air Volume Inside of Ducts

To calculate the air volume passing through ducts, it is necessary first to calculate the average velocity inside the duct, based

on the measurements of the flow velocities within various parts of the duct cross section. Then the cross section of the duct must be calculated and then, based on the average velocity and the cross section area of the duct, the air volume passing through the duct can be calculated.

Using the following equation:

$$Q = AV$$

Where		English Units	Metric Units
Q	Quantity of air	ft^3/min	m^3/s
A	Cross section area	ft^2	m^2
V	Average flow velocity	ft/min	m/s

To calculate the average velocity within a duct, several methods can be utilized.

For rectangular ducts, mentally divide the duct into at least nine equal areas (preferably more) that are approximately square. Take readings at the centers of these areas and average them.

For round ducts a total of 20 readings is recommended; 10 readings across each of two diameters at right angles to each other.

A quicker, though less accurate method, may be used for field testing when a straight run of duct of at least 10 diameters is available. Never use this method if such a straight run of duct is not available. Take a single center line reading and multiply it by 0.9 to obtain an estimated average velocity.

In a circular duct it is advisable to use a traversing method whereby the entire duct cross section area is divided into a number of concentric ring sections of equal area as shown in figure 2. The center distances of the individual areas have been calculated for 6, 8 and 10 point traverses and are tabulated in Tables 4 through 7.

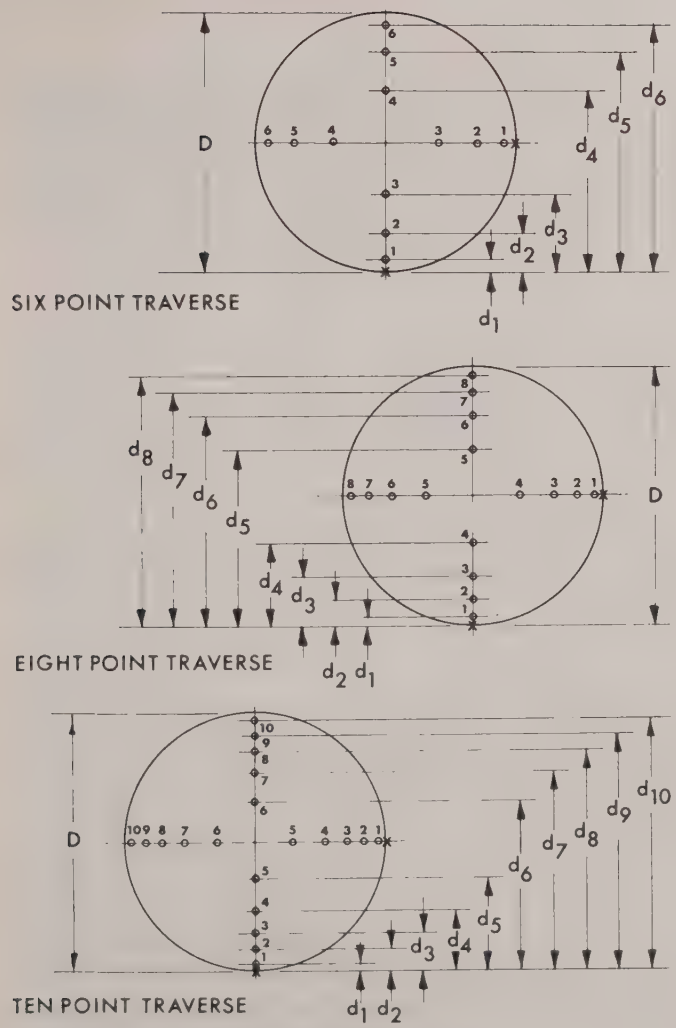

Figure 2. 6-, 8- and 10- Point Traverse Method

A traverse should be made across two perpendicular diameters. For the 6, 8 and 10 point traverse method, the distances from the reference point for a variety of duct diameters have been calculated. Table 4 shows the distances of the individual measuring points from the reference point expressed in pipe diameters. Tables 5, 6 and 7 show the required probe immersions from the reference point expressed in inches.

Traverse Method	Table 4. Probe Immersion as a Function of Duct Diameter									
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}
6 point	0.043	0.147	0.296	0.704	0.853	0.957	—	—	—	—
8 point	0.032	0.105	0.194	0.323	0.677	0.806	0.895	0.968	—	—
10 point	0.025	0.082	0.146	0.226	0.342	0.658	0.774	0.854	0.918	0.975

Duct Dia. (In.)	Table 5. Probe Immersion for 6 pt. Traverse					
	d_1	d_2	d_3	d_4	d_5	d_6
10	3/8	1-1/2	3	7	8-1/2	9-5/8
12	1/2	1-3/4	3-1/2	8-1/2	10-1/4	11-1/2
14	5/8	2	4-1/8	9-7/8	12	13-3/8
16	3/4	2-3/8	4-3/4	11-1/4	13-5/8	15-1/4
18	3/4	2-5/8	5-3/8	12-5/8	15-3/8	17-1/4
20	7/8	3	6	14	17	19-1/8
22	1	3-1/4	6-1/2	15-1/2	18-3/4	21
24	1	3-1/2	7-1/8	16-7/8	20-1/2	23

Duct Dia. (in.)	Table 6. Probe Immersion for 8 pt. Traverse							
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8
10	5/16	1	2	3-1/4	6-3/4	8	9	9-5/8
12	3/8	1-1/4	2-3/8	3-7/8	8-1/8	8-3/4	10-3/4	11-1/2
14	7/16	1-1/2	2-3/4	4-1/2	9-1/2	11-1/4	12-1/2	13-1/2
16	1/2	1-5/8	3-1/8	5-1/8	10-7/8	12-7/8	14-3/8	15-1/2
18	9/16	1-7/8	3-1/2	5-7/8	12-1/4	13-1/2	16-1/8	17-1/2
20	5/8	2-1/8	3-7/8	6-1/2	18-1/2	16-1/8	17-7/8	19-3/8
22	11/16	2-3/8	4-1/4	7-1/8	14-7/8	17-3/4	19-3/4	21-1/4
24	3/4	2-1/2	4-5/8	7-3/4	16-1/4	19-1/2	21-1/2	23-1/4

DUCT Dia. (In.)	Table 7. Probe Immersion for 10 pt. Traverse									
	d_1	d_2	d_3	d_4	d_5	d_6	d_7	d_8	d_9	d_{10}
10	1/4	7/8	1-1/2	2-1/4	3-3/8	6-5/8	7-3/4	8-1/2	9-1/8	9-3/4
12	1/4	1	1-3/4	2-3/4	4-1/8	7-7/8	9-1/4	10-1/4	11	11-3/4
14	3/8	1-1/8	2	3-1/8	4-3/4	9-1/4	10-7/8	12	12-7/8	13-5/8
16	3/8	1-1/4	2-3/8	3-5/8	5-1/2	10-1/2	12-3/8	13-5/8	14-3/4	15-5/8
18	1/2	1-1/2	2-5/8	4-1/8	6-1/8	11-7/8	13-7/8	15-3/8	16-1/2	17-1/2
20	1/2	1-5/8	2-7/8	4-1/2	6-7/8	13-1/8	15-1/2	17-1/8	18-3/8	19-1/2
22	1/2	1-3/4	3-1/4	5	7-1/2	14-1/2	17	18-3/4	20-1/4	21-1/2
24	5/8	2	3-1/2	5-3/8	8-1/4	15-3/4	18-5/8	20-1/2	22	23-3/8

6.5 Air Velocity at Exhaust Openings

When measuring air velocity at exhaust openings, the probe should be held as close as possible to the edge of the opening, with the plane of the element perpendicular to the air flow.

Measure exhaust openings at grinding or buffing wheels only when no work is in progress to avoid contamination of the sensing element.

When measuring velocity at spray booths, place the probe in the plane defined by the entry edge of the booth.

7. Maintenance

Owner's maintenance of the Type 8500 Thermo-Anemometer consists of occasional cleanings and replacement of the power cell. Need for replacement of the cell is indicated whenever the 'T' adjustment cannot be made. To replace the cell, remove the two screws which hold the battery compartment cover in place, and lift off the cover. Tip the meter until the power cell slides out.

Before installing the new power cell, wipe a very thin film of petroleum jelly on each end of the cell. Insert the cell into the battery compartment with the positive (+) end upward. Re-attach cover to the compartment.

It may sometimes happen that a new power cell appears to be too strong to allow the indicator pointer to be set exactly on the T mark on the scale. If this occurs, leave the selector switch on the T position for a few minutes and the pointer will gradually move down to the T mark. A new power cell should provide about 85 hours of operation.

The power cell should be examined at least every two months for signs of corrosion. Remove the power cell. If there is any corrosion on the ends of the power cell, on the compartment cover, or in the compartment, clean the affected parts with a cloth moistened with water only. Allow all parts to dry thoroughly and re-install the power cell.

The probe may be cleaned by immersing it in denatured or iso-propyl alcohol, and drying in a gentle stream of air.

8. Storage Notes

If the Thermo-Anemometer is to be stored for periods exceeding 30 days, remove the power cell and store it separately in a plastic container to avoid damage from possible cell leakage.

If the Thermo-Anemometer has been in a cold environment with the power cell installed, it may not be possible to make the 'T' adjustment, although the condition of the cell may be good. In such cases, allow the instrument and probe to reach room temperature, then make the 'T' adjustment.

If moisture condensation appears on the probe, allow it to dry throughly before use. A gentle stream of air at room temperature will quickly dry the probe element. **Do not apply direct heat.**

Instructions For Return

Damage in Shipment

The product should be examined as soon as it is received. If it is physically damaged a claim should be filed promptly with the carrier. A full report of the damage should be obtained by the claim agent and forwarded to Alnor. Alnor will then notify the customer of the disposition to be made and arrange for repair or replacement. The instrument model and serial numbers should be referenced in any communication to the factory.

Malfunction

If any fault develops, the following steps should be taken:

1. Notify the factory, stating model and serial number, and details of the difficulty.
2. Upon receipt of shipping instructions, send the product to the factory with your purchase order, transportation prepaid. If the product is not under warranty, a charge will be made. If the customer requests, an estimate can be made before work is started.

Shipping

All Alnor products should be packed in strong containers and surrounded by at least two inches of suitable shock-absorbing material.

Ship to:

Alnor Instrument Company
7300 North Natchez Avenue
Niles, Illinois 60648

Warranty Repair Information Form

Contact Alnor Instrument Company before returning your Alnor instrument to the factory. Send your Alnor instrument prepaid. To assure fast turn-around time fill out this form with as much detail as possible. and attach it to the instrument.

Instrument Model No. _____

Serial No. _____

Describe malfunction: _____

_____

_____

_____

Describe environment (used in system, used as bench instrument, operating temperature, etc.):

_____

_____

_____

Ship instrument to:

Name _____

Address _____

_____

Phone _____

Address Correspondence to:

Name _____

Address _____

_____

Phone _____

WARRANTY

The Seller warrants to the Purchaser that any equipment manufactured by it and bearing its nameplate to be free from defects in material or workmanship, under proper and normal use and service, as follows: If, at any time within one (1) year from the date of shipment, the Purchaser notifies the Seller that in his opinion, the equipment is defective, and returns the equipment to the Seller's originating factory prepaid, and the Seller's inspection finds the equipment is defective in material or workmanship, the Seller will promptly correct it by either, at its option, repairing any defective part or material or replacing it free of charge and return shipped lowest cost transportation prepaid (if Purchaser requests premium transportation, Purchaser will be billed for difference in transportation costs). If inspection by the Seller does not disclose any defect in material or workmanship, the Seller's regular charges will apply. This warranty shall be effective only if installation and maintenance is in accordance with our instructions and written notice of a defect is given to the Seller within such period. This warranty is exclusive and is in lieu of any other warranties, written, oral or implied; specifically, without limitation, there is no warranty of merchantability or fitness for any purpose. The liability of the Seller shall be limited to the repair or replacement of materials or parts as above set forth.

LIMITATION OF LIABILITY

The Seller shall not be liable for any claim for consequential or special loss or damage arising or alleged to have arisen from any delay in delivery or malfunction or failure of the equipment. The Seller's liability for any other loss or damage arising out of or connected with the manufacture, sale or use of the equipment sold, including damage due to negligence, shall not in any event exceed the price of the equipment supplied by us.

Alnor Instrument Company reserves the right to make changes at anytime, without notice, in prices, colors, materials, specifications and models, and also to discontinue models.

WARRANTY CARD

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(312) 647-7866 • TELEX 72-4458

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